# EFFECT OF 24 DAYS LIVING HIGH AND TRAINING LOW ON ERYTHROPOIESIS AND PERFORMANCE IN SWISS NATIONAL TEAM ORIENTEERS

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***Introduction.*** The concept of live high:train low (LHTL) to enhance hematological parameters for improving sea level endurance performance in elite athletes remains controversial [1], [2], [3]. This possibly results from different "doses" of hypoxia and methods to estimate red cell volume (RCV). It has been questioned [3] if the method to estimate red cell volume (RCV) could have influenced these conflicting results: Most studies using the "evans blue dye" technique showed an increase in RCV while with one exception [4] studies using the CO-rebreathing method did not increase RCV. However, it seems to be obvious that an increase in RCV with altitude exposure is more a question of the exposure time at altitude and the height of the altitude exposure itself than a question of method to measure RCV. The aim of this study was to determine the effect of 24 days LHTL on RCV, $Hb_{mass}$ (using CO-rebreathing technique), running performance and maximal oxygen uptake ($VO_{2max}$) in highly endurance trained athletes.

***Methods.*** Ten iron supplemented Swiss National Team Orienteers (5 females and 5 males) lived for 24 days at an altitude of 2456m (approximately 18h per day), performed base training (1-2 times per day) at 1800m and interval training (2 times per week) at 1000m above sea level. This "dose" of LHTL has previously been shown to increase RCV (evans blue dye technique), $VO_{2max}$ and decrease 5000m running time. Pre altitude (-2 days) and post altitude (+ 8 days), we measured $VO_{2max}$ on a treadmill, 5000m running time, RCV and $Hb_{mass}$. In a pilot investigation (n=12), the coefficient of variation was 2.2% for RCV and 1.7% for $Hb_{mass}$. Differences between pre- and post altitude were determined with paired students t-tests. Results are presented as means ± SD.

***Results.*** RCV increased (females: 1818 ± 226 vs 1891± 171 ml; males: 2881 ± 309 vs 3049 ± 305 ml; $p<0.001$), as well as $Hb_{mass}$ (617 ± 58 vs 646 ± 52 g; 991 ± 95 vs 1052 ± 95 g; $p<0.001$) and $VO_{2max}$ (50.8 ± 2.1 vs 54.5 ± 2.8 ml/kg/min; 62.3 ± 5.2 vs 63.8 ± 5.5 ml/kg/min; $p<0.05$), while 5000m running time decreased (1177.3 ± 44.7 vs 1154.2 ± 43.3 sec; 1000.7 ± 57.7 vs 988.4 ± 51.6 sec; $p<0.01$) from pre- to post altitude. The increase in $Hb_{mass}$ correlated with the increase in $VO_{2max}$ (females: $r = 0.75$; males: $r=0.67$).

***Discussion/Conclusion.*** The LHTL camp increased RCV (5.2%) and $Hb_{mass}$ (5.5%), which contributed to an increased $VO_{2max}$ (4.5%) and improved 5000m running time (-18.3 ± 14 sec). Our study is one of very few to show an increase in RCV and $Hb_{mass}$ after a LHTL camp estimated with the CO-rebreathing method. This suggests that 24 days living at 2500m and training at 1800m and 1000m is an adequate "dose" of hypoxia to increase RCV and $Hb_{mass}$ and that these changes can be monitored with the CO-rebreathing technique. We conclude that LHTL enhances the sea level performance of elite endurance trained athletes in a relevant size.

***References***

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